

Now Available in the United States and Canada: Aerobic Granular Sludge

by Brian Bates

Developments in wastewater treatment processes and products are happening around the world. Aerobic granular sludge (AGS) is a novel microbial community that allows simultaneous removal of carbon, nitrogen, phosphorus and other pollutants in a single sludge system (Nancharaiah and Kiran Kumar Reddy 2018).

The key difference between AGS and conventional biological nutrient removal is the granule itself. Within the granule (Figure 1), the DO concentration drops off as you move towards the center, thereby creating an aerobic zone (outside layer), anoxic zone (intermediate layer) and anaerobic zone (middle of the granule) as opposed to multiple tanks found within a conventional system to create those same zones.

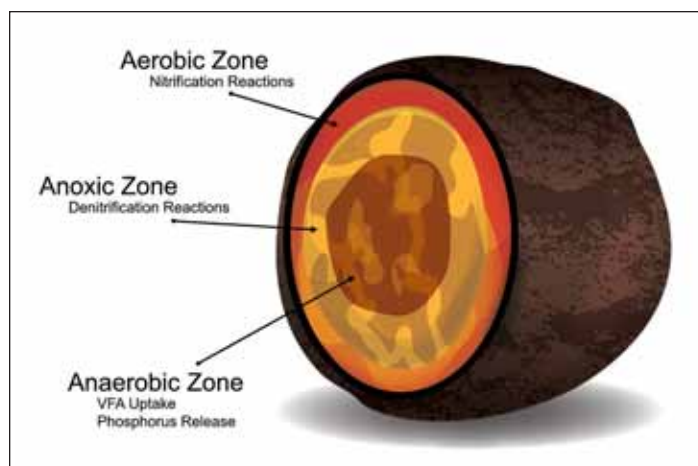


Figure 1: AquaNereda granule illustration shows three zones with different oxygen levels.

Research has demonstrated that AGS technology can effectively be implemented for the treatment of domestic wastewater (Pronk et al 2015). AGS technology, under the brand name Nereda®, is a biological wastewater system that provides advanced treatment using the unique features of aerobic granular biomass.

The Nereda Process

The Nereda process was created by a public-private partnership with Delft University, Dutch Water Authorities and Royal HaskoningDHV in the Netherlands. In 2016, Aqua-Aerobic Systems, Inc. signed an agreement with Royal HaskoningDHV to become the exclusive provider of the Nereda granular biomass wastewater treatment system in the United States and Canada, where it is marketed under the brand AquaNereda® Aerobic Granular Sludge Technology (Royal HaskoningDHV 2016).

The technology has been used successfully for more than 12 years in full-scale wastewater treatment facilities, with over 50 plants currently in operation or under design and construction. This experience has demonstrated that the technology offers several advantages when compared to conventional activated sludge systems, including:

- Significant footprint reduction in terms of the space occupied in the treatment facility.
- Energy and chemical savings under a wide range of influent characteristics, applications and climates.

Pilot Study

To introduce the technology to the North American market, Aqua-Aerobic Systems planned to build a demonstration facility.

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Full-scale installation of Nereda AGS technology, Epe, Netherlands, June 2015.

Royal HaskoningDHV

First, however, a four-week AGS pilot study was completed at Rock River Water Reclamation District (RRWRD) in Rockford, Illinois, in the spring of 2017. The pilot unit was equipped with two independent AGS reactors. Both reactors were seeded to a mixed liquor suspended solids (MLSS) strength of 8 g/L with aerobic granules shipped from a full-scale Nereda aerobic granular sludge plant overseas.

One of the primary objectives of the pilot was to demonstrate the rapid acclimation of granules that had been dormant in shipping containers for three months. Nitrification was observed within two and a half weeks of start-up. Within four weeks, BOD₅ and total suspended solids (TSS) were both reduced to less than 10 mg/L, total nitrogen (TN) and total phosphorous (TP) were reduced to less than 3 mg/L and 0.8 mg/L, respectively. The pilot study performance was comparable to the performance of existing full-scale plants.

Demonstration Project

Following the pilot study, Aqua-Aerobic Systems built a 757 m³/d (200,000 gpm) demonstration facility at the RRWRD in Rockford, Illinois. This fully automated system was put into operation in January 2018.

The AquaNereda demonstration facility is unique in that it is capable of operating at a range of process water level depths. This allows the distinctive advantages of AGS to be demonstrated at the various process depths often seen in retrofit applications. The demonstration facility also provides Aqua-Aerobic Systems with two additional functions:

- The facility is a North American site to grow and store seed granules for plants in the United States and Canada that need

to accelerate biological nutrient removal during commissioning of new plants.

- The facility is an easily accessible aerobic granular sludge site for engineers and plant operators in North America to visit and learn more about the technology.

The analytical results obtained from the demonstration plant at start-up (**Table 1**) exhibited the same performance as the initial pilot studies, showing that pilot studies are representative of full-scale performance.

Table 1. AquaNereda® Demonstration Plant (RRWRD) Effluent Results.

Parameter	Influent (mg/L)	Effluent (mg/L)
COD	262	18
BOD ₅	116	2
TSS	128	8
TN	30	2.6
NH ₄ -N	11	<0.1
TP	2.6	0.9

Overall, the RRWRD demonstration plant produces the same effluent quality as seen at more than 50 full-scale Nereda installations around the world. Operation at this demonstration facility is now focused on varying process water depths, increased MLSS strength, solids handling, and various process control strategies.

Should you implement this technology at your plant? There are many factors to consider. This is a custom-engineered plant, so footprint requirements, energy needs, capital investment, and operation and maintenance costs for each implementation are assessed on a case-by-case basis. For more information about the AquaNereda process, visit the web site at www.aquanereda.com.

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References

- Nancharajah, Y.V. and G. Kiran Kumar Reddy. 2018. "Aerobic granular sludge technology: Mechanisms of granulation and biotechnological applications." *Bioresource Technology*. 247: 1128-1143. ISSN 0960-8524. <https://doi.org/10.1016/j.biortech.2017.09.131>.
- Pronk, M., M.K. de Kreuk, B. de Bruin, P. Kamminga, R. Kleerebezem and M.C.M. van Loosdrecht. 2015. "Full scale performance of the aerobic granular sludge process for sewage treatment." *Water Research*. 84: 207-217. ISSN 0043-1354. <https://doi.org/10.1016/j.watres.2015.07.011>. (<http://www.sciencedirect.com/science/article/pii/S0043135415301147>)
- Royal HaskoningDHV. 2016. "Royal HaskoningDHV's Nereda technology is entering the United States." Royal HaskoningDHV. September 27. Accessed November 26, 2018. <https://www.royalhaskoningdhv.com/en-gb/news-room/news/royal-haskoningdhvs-nereda-technology-is-entering-the-united-states/6686>.



Visitors at the AquaNereda demonstration plant (RRWRD) in Rockford, Illinois, September 2017. *Aqua Aerobic Systems Inc.*

